National Aeronautics and
Space Administration

MAY 10 1979
JSC 13830
MAY 1979

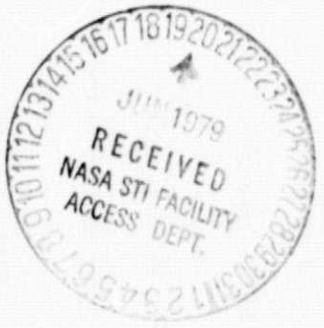
Lyndon B. Johnson Space Center
Houston, Texas 77058

IMPLEMENTATION PROCEDURE

FOR

STS PAYLOADS

SYSTEM SAFETY REQUIREMENTS



PREFACE

This procedure was prepared to assist Space Transportation System Payload organizations in complying with the system safety requirements established by NASA Headquarters. The requirements for safety analyses and assessment reviews are explained in detail, and instructions are given for implementing the requirements.

M. L. Raines
Director
Safety, Reliability, and
Quality Assurance
Johnson Space Center

Glynn S. Lunney
Manager
Shuttle Payload Integration
and Development Program
Johnson Space Center

J. R. Atkins
Director
Safety, R&QA, and Protective
Services
Kennedy Space Center

J. J. Neilon
Manager
Cargo Projects Office
Kennedy Space Center

CONTENTS

FIGURES

1.0 INTRODUCTION. The NASA Headquarters SP&R document NHB 1700.7 (Safety Policy and Requirements for Payloads Using the Space Transportation System), establishes both technical and system safety requirements applicable to all STS (space transportation system) payloads. It is equally applicable to all payload hardware including new design, existing design (reflown hardware), and hardware designed primarily for commercial use. The Implementation Procedure for STS Payloads System Safety Requirements has been developed to assist the payload organization in implementing the system safety requirements identified in the SP&R document.

The implementation task is a joint responsibility of the payload organization, the flight operator (JSC), and the launch/landing site operator (KSC). The implementation procedures for single element type payloads and experiment payloads (such as Spacelab experiments and pallets or other types of carriers involving a group of individual experiments) are different and will be addressed separately in sections 5.0 and 7.0, respectively. If, however, individual experiments are integrated into the STS as a singular entity, they are classified as payloads and will be treated in the same manner as a single element type payload.

Payload organizations are responsible for assuring that payload systems, including GSE (ground support equipment), comply with NASA safety requirements, and in doing so, are required to perform a safety analysis and submit a safety assessment report on each STS payload for ground and flight operations. The safety analysis begins during the payload concept phase and is refined and expanded as the payload design matures. The safety analysis results are recorded on the safety matrix, hazard list, and hazard report forms and presented to the safety review panel as described in this document. This process fulfills the NASA requirement for a hazard analysis and safety assessment report.

2.0 PURPOSE. The purpose of this document is to provide guidelines and instructions for the implementation of the SP&R system safety requirements applicable to STS payloads.

3.0 SCOPE. This document describes the initial contact meeting with the payload organization and defines the subsequent safety reviews necessary to comply with the system safety requirements of the SP&R document. Waiver instructions are included for the cases in which a safety requirement cannot be met.

The launch/landing site content of this document is limited to ground operations at KSC. Implementation of the Vandenberg Air Force Base launch/landing site STS payload safety requirements will be addressed in a future update of this document when that launch/landing site becomes operational.

4.0 INITIAL CONTACT MEETING. An informal initial contact meeting will be held at the earliest appropriate time prior to the phased safety reviews. The payload organization will notify the Manager, STS Operations Office, code PF, JSC, to establish the initial contact meeting. During this meeting, the payload organization will be briefed by the flight operator and the launch/landing site operator. Included in the briefing will be an overview of the technical and system safety requirements to be met by the payload organization, plus instructions for the conduct of the safety reviews. The payload organization will be provided with the documents and forms necessary for developing the safety assessment report. The payload organization will be asked to provide a schedule of payload milestones and to request a phase 0 safety review when the payload design concept has been developed.

5.0 SAFETY REVIEWS. Payload safety review panels have been established by JSC and KSC to assist the flight operator, who has prime responsibility for payload design and flight operations safety, and the launch/landing site operator who has prime responsibility for GSE design and ground operations safety. The panels are staffed by the appropriate technical disciplines and are responsible for conducting the phased safety reviews. It is intended that the reviews cover all aspects of safety in payload design, flight operations, GSE design, and ground operations to assure compliance with the STS safety requirements.

For convenience of the payload organization, it is NASA policy to be flexible with the timing and location of the safety reviews. For example, at the option of the payload organization, the GSE design and ground operations safety reviews may be held back-to-back with the payload design and flight operations safety reviews at JSC or they may be conducted separately at KSC. However, separate reviews at KSC may be necessary because of STS travel and manpower constraints. The timing and location of the GSE design and ground operations safety reviews must be coordinated by the payload organization with the KSC Cargo Projects Office, Code CP, Kennedy Space Center, Florida 32899.

The safety reviews may be conducted at four levels of design maturity: Phase 0 through phase III. The phase 0 safety review will normally be an informal review chaired by a JSC Safety representative for payload design and flight operation and a KSC Safety representive for GSE design and ground operations. The phase I through phase III safety reviews are formal reviews conducted by the safety review panels. During the formal reviews, the payload organization should be prepared to give a presentation which includes a brief description of the payload and its operation, followed by data unique to the phase being reviewed.

The depth and number of the formal reviews are determined by the safety review panel chairman in conjunction with the payload organization and are dependent on the complexity, technical maturity, and hazard potential of the payload.

The timing and objectives of the safety reviews are listed below:

PHASE	TIME	OBJECTIVES
0	Concept	Identify safety-critical subsystems, groups, hazards, and applicable safety requirements for subsystems and associated ground operations.
I	Preliminary Design Review	Assess the implementation approach, review hazards and resolution, and develop an understanding of verification approach.
II	Critical Design Review	Verify design compliance with requirements, review verification methods.
III	Delivery to Customer	Validate the incorporation of previous safety review agreements, assure the satisfactory completion of safety verification activities, provide agreement that safety activities have been satisfactorily completed.

Data that will be presented at the phase 0 through phase III safety review meetings shall be submitted by the payload organization to the Manager, STS Operations Office, code PF, Johnson Space Center, Houston, Texas 77058, for flight and to Chief, Safety Operations Office, code SF-S00, Kennedy Space Center, Florida 32899, for GSE and ground operations. The safety review meetings will be scheduled 30 days after receipt of the data. A copy of each original approved and signed hazard report should be included with the data submitted; however, the original of each completed hazard report must be available to the safety review panel chairman for his signature at the time of each review. The payload organization is responsible for retaining and maintaining the original hazard reports.

5.1 PHASE 0 SAFETY REVIEW. During the concept phase of the payload and GSE development, a preliminary system-level safety analysis is performed by the payload organization to determine hazard groups associated with payload subsystem elements and to identify hazards. The results of this analysis are documented by the payload organization on a safety matrix (JSC Form 542) and a hazard list (JSC Form 542A). Instructions for completion of the safety matrix and hazard list are shown in figures 1 and 2, respectively.

For a single element type payload, one matrix and one or more pages listing the titles of hazards will suffice.

The following data are required for a phase 0 safety review:

a. Payload description and operation.

b. Hardware description of safety critical subsystems (existing level, new and reflown).

c. Payload safety matrix.

d. Hazard list.

The payload description and operation should be of sufficient detail to permit identification of all subsystems, with emphasis on stored energy, which have potential for creating hazards.

During the phase 0 safety review the payload organization should address tentative plans for any operation that would require personnel training and certification for hazardous procedures including both flight and ground operations.

5.2 PHASE I SAFETY REVIEW. During the early design phase, the safety analysis is refined and expanded by evaluating each hazard for means of eliminating, reducing, or controlling the hazard and by identifying the approach for verifying compliance with the safety requirements. The results of this effort are documented on a hazard report form (JSC Form 542B). Instructions for completion of the hazard report are shown in figure 3.

To aid the payload organization in performing the hazard analysis, a sample schematic of a safety-critical subsystem along with examples of a completed safety matrix, hazard list, and hazard report are shown in figures 4 through 7, respectively.

For the single element type payload and its associated GSE, one hazard report for each hazard is required. For reflown hardware, existing analyses should be reviewed to determine if the SP&R requirements have been met. If no deficiencies exist, the analyses may be summarized on one hazard report form.

Each hazard report should stand alone; therefore, it must be supported by data such as block diagrams, schematics, a description of safety-critical subsystems and their operations, and nonmetallic material and radioactive source information. The block diagram or preliminary schematic should indicate the design approach which is intended to control the identified hazard. Partial diagrams and schematics are satisfactory provided the element for hazard control is identified.

The radioactive source questionnaire (JSC Form 44) shall be completed at the time of the phase I safety review. The data provided on this form will suffice for initial information transfer of radioactive source data required by both JSC and KSC. An example of a completed radioactive source questionnaire is shown in figure 8. The need for additional information will be based on the source, the quantity, and the proposed method of usage. The details associated with handling of radioactive material at the launch/landing site will be negotiated at the ground operations and GSE phase 0 safety review. Consideration shall also be given to constraints on the receipt, use, and transfer of materials as authorized by the Nuclear Regulatory Commission.

Preliminary materials safety assessments (addressing flammability, offgassing, and materials compatability with hazardous fluids as applicable) should be conducted for the phase I safety review and documented on payload hazard reports. If detail materials information is required to support these reports, the data should be submitted on a Payload Materials Usage List, JSC Form 542D (Figure 9).

The following data, which must be submitted 30 days in advance, are required for the formal presentation at the phase I safety review:

a. Block diagrams, schematics, and/or a description of safety-critical subsystems and their operations.

b. Hazard reports.

c. Payload assembly and checkout operations to be conducted at KSC, with preliminary timelines.

d. Radioactive source questionnaire.

5.3 PHASE II SAFETY REVIEW. As the payload and GSE design is completed and refined, the safety analysis is further updated and expanded. The original signed hazard reports completed at phase I are updated to include additional data on control of the hazard causes and safety verification methods.

The following data are required for a phase II safety review:

a. Safety-critical subsystem descriptions (update).

b. Engineering drawings of safety-critical subsystems when specifically requested.

c. Payload assembly and checkout operations to be conducted at KSC (update).

d. A list of safety-related failures or accidents.

e. A list of technical operating procedures related to identified hazard controls and date of availability for review.

f. Updated hazard reports and support data including the following:

(1) A list of equipment generating hazardous radiation.

(2) Radioactive source questionnaire (update).

5.4 PHASE III SAFETY REVIEW. The safety analysis is completed at the time of the phase III safety review. The hazard reports completed at phase II are updated and submitted for final approval. All the safety compliance data required by the SP&R document are submitted for review at this time. The official submittal of the safety compliance data will precede the hardware delivery by 30 days. The safety assessment report, which is part of the safety compliance data, includes the completed hazard reports and the identification of any open safety items.

The following data are required for a phase III safety review:

a. Updates of safety-critical subsystems descriptions.

b. Updates of safety-critical subsystem engineering drawings when specifically requested.

c. Results of applicable safety verification tests and analyses.

d. Safety compliance data as defined in the SP&R document.

All open items are tracked and closeout is formally documented in correspondence with the payload organization. The final safety status of the payload will be presented to the Flight Readiness Review Board.

6.0 WAIVERS. When a specific safety requirement cannot be met, a completed waiver request, JSC Form 542C (figure 10) shall be submitted by the payload organization to the Manager, STS Operations Office, code PF, JSC, for flight. Waiver requests for GSE and ground operations shall be submitted to the Director, Safety, R&QA, & Protective Service, code SF, Kennedy Space Center, Florida 32899. All waiver requests should be coordinated with the appropriate NASA Center prior to submittal and should be formally submitted as soon as it is determined that a safety requirement cannot be met. Each waiver request will address only one hazard or hazard cause. After initial coordination, the waiver request will be formally submitted for approval. The payload organization will be formally notified of the acceptance or rejection of the waiver request. Approval of the waiver request will not relieve the payload organization of the responsibility of meeting the waiver requirement in all other areas of design and operation of the payload.

7.0 EXPERIMENT PAYLOADS. This section defines the variances to the basic procedures of section 5.0 for conducting experiment payloads flight operator safety reviews.

Experiment payloads are defined as assemblies of experiments mounted and/or operated on or within a dedicated carrier structure and/or the Orbiter. The carrier structure will be considered as part of the experiment payload, unless excluded by prior agreement with the STS Operator.

This section does not alter the procedures for conducting the launch/landing site operator safety reviews as defined in section 5.0. If similar procedures to those defined herein are requested for GSE design and ground operations safety reviews, they should be coordinated with the KSC Cargo Projects Office.

7.1 PAYLOAD ORGANIZATION. The payload mission manager shall be designated as the payload organization for experiment payloads. However, when individual experiments are developed without a specific experiment payload assignment, the single point of contact for STS payloads system safety at the applicable NASA Center shall assume the safety tasks of the payload orgainzation until the experiment is assigned.

7.2 INDIVIDUAL EXPERIMENT DATA SUBMITTALS. Safety data on individual experiments may be submitted in advance for flight operator acceptance apart from the formal payload safety reviews. In addition the data may be submitted by the single point of contact for STS payloads system safety prior to the experiment being assigned to a specific experiment payload with a designated mission manager. These advanced submittals should contain all the applicable experiment safety data for the level of acceptance being requested as defined in this section and in 5.0. The flight operator's disposition of these data (concurrence/approval of hazard reports, action items, etc.) will be the same as if the data were presented at a formal payload safety review. The mission manager or the single point of contact for STS payloads system safety must schedule all advanced data submittals with the Executive Secretary, STS Payload Safety Review Panel, Mail Code NS2, Johnson Space Center, Houston, TX 77058.

7.3 PAYLOAD SAFETY REVIEWS. Formal STS Payload Safety Review Panel meetings on experiment payloads are normally convened only for reviewing the total integrated payload (i.e., experiments, applicable carrier structure, and all interfaces). These safety reviews should be scheduled when all the experiments listed on the manifest for a particular mission are at or above the following levels of design maturity: phase 0, concept; phase 1, preliminary design; phase II, final design; and phase III, delivery. The actual review dates will be 30 days after JSC receives the integrated payload safety data submittal. Individual ESP's (experiment safety packages) that are signed by the flight operator prior to the payload safety review should be a part of the integrated payload safety data submittal.

7.3.1 PHASE 0. Since the objective of the phase 0 is to conduct a preliminary system level safety analysis and to baseline a list of hazards, the phase 0 data should include conceptual descriptions of the experiments, operations, interfaces, and safety-critical hardware. A safety matrix (JSC Form 542) and a hazard list (JSC Form 542A) are required for each individual experiment and for the carrier structure (if it is included as part of the experiment payload).

Since only a conceptual level of design will be available for review, many interface hazards may not be definable. Interface hazards for experiment payloads include interactions of experiment to experiment, experiment-to-Orbiter/carrier structure, and carrier structure to Orbiter (if applicable). If any interface hazards are identified and these hazards are not already addressed in the individual experiment

hazard lists, a separate matrix and hazard list for interface hazards should be prepared. As the design matures and the interfaces are better developed, additional interface hazards should be added as required. A complete baseline of interface hazards should be submitted at phase I.

7.3.2 PHASE I. Hazard reports (JSC Form 542B) are prepared to address each hazard identified on the hazard lists for the individual experiments, the carrier structure (if applicable), and the interfaces. All hazard reports for an individual experiment shall be contained in an ESP. An ESP shall include (1) a signature cover sheet (JSC Form 542E); (2) all applicable hazard reports, including support data; and (3) a list of safety review actions, if assigned. Instructions for JSC Form 542E are contained in figure 11. Each ESP and each interface hazard report shall stand alone (i.e., it shall contain supporting data similar to that specified in paragraph 5.2).

Phase I safety review concurrence in the ESP's shall be documented by the flight operator's signature on the cover sheets at the completion of the phase I safety review. The individual hazard reports in the ESP's will not be signed by the flight operator. Concurrence in the remaining hazard reports shall be the same as defined in section 5.0.

7.3.3 PHASE II. For the phase II safety review, the original signed phase I ESP's and interface hazard reports are updated to include additional data on the control of hazard causes and safety verification methods. Phase II safety review concurrence will be documented in the same manner as phase I.

7.3.4 PHASE III. The interface hazard reports and the ESP's completed at phase II are updated and submitted for final approval. The safety assessment report shall include the completed interface hazard reports and the ESP's. STS operator approval signature will be required on each ESP and on each interface hazard report.

PAYLOAD SAFETY MATRIX

PAYLOAD	PAYLOAD ORGANIZATION	DATE	PAGE

HAZARD GROUP / SUBSYSTEM	COLLISION	CONTAMINATION (TOXICITY, ETC)	CORROSION	ELECTRICAL SHOCK	EXPLOSION	FIRE	INJURY AND ILLNESS	LOSS OF ENTRY CAPABILITY	RADIATION	TEMPERATURE EXTREMES								
Biomedical																		
Hazard Detection and Safing*																		
Cryogenics																		
Electrical																		
Environmental Control																		
Human Factors																		
Hydraulics																		
Materials																		
Mechanical																		
Optical																		
Pressure Systems																		
Propulsion																		
Pyrotechnics																		
Radiation																		
Structures																		

NOTE: Hazard groups and subsystems are defined and described in JSC 11123, STS Payload Safety Guidelines Handbook. The subsystems list may be expanded or modified for specific payloads/GSE. The intent of this form is to assist the Payload Organization in identifying hazards associated with the payload/GSE.

INSTRUCTIONS:

1. For a single element type payload prepare two matrixes, one for the payload and another for GSE/ground operations. For experiment payloads prepare matrixes for the following:
   a. one for each experiment
   b. one for interface hazards
   c. the carrier structure (if applicable)
   d. GSE/ground operations
2. Complete blocks for payload/GSE/experiment title, payload organization, date, and page.
3. Determine safety subsystem elements.
4. For each identified safety subsystem element, check the hazard group(s) that could apply. This will be based on the particular hardware, design, and operation of the subsystem. JSC 11123 may be used as a guide to determine if a hazard group applies.

JSC Form 542 (Feb 78) NASA-JSC

*Reference "Caution and Warning" in JSC 11123.

Figure 1

HAZARD LIST

PAYLOAD	SUBSYSTEM	DATE

HAZARD GROUP	HAZARD TITLE	APPLICABLE SAFETY REQUIREMENT

PAYLOAD - Enter title of payload, or payload GSE. (For experiment payloads enter payload or experiment title as applicable)

SUBSYSTEM - Enter subsystem checked on Safety Matrix.

DATE - Enter date form is completed or revised.

HAZARD GROUP - Enter hazard group (checked on Safety Matrix) that corresponds to the subsystem above.

HAZARD TITLE - Enter hazard title(s) which identify the safety concern for each hazard group listed. Hazards are identified from safety analysis.

APPLICABLE SAFETY REQUIREMENTS - Enter the SP&R paragraph numbers for the technical requirements that are related to each identified hazard.

Complete the Hazard List for each subsystem checked on the Payload Safety Matrix. Hazard lists for more than one subsystem may be included on one hazard list form (see figure 6).

A separate hazard list should be prepared for GSE and ground operations.

JSC Form 542A (Feb 78) NASA-JSC

Figure 2

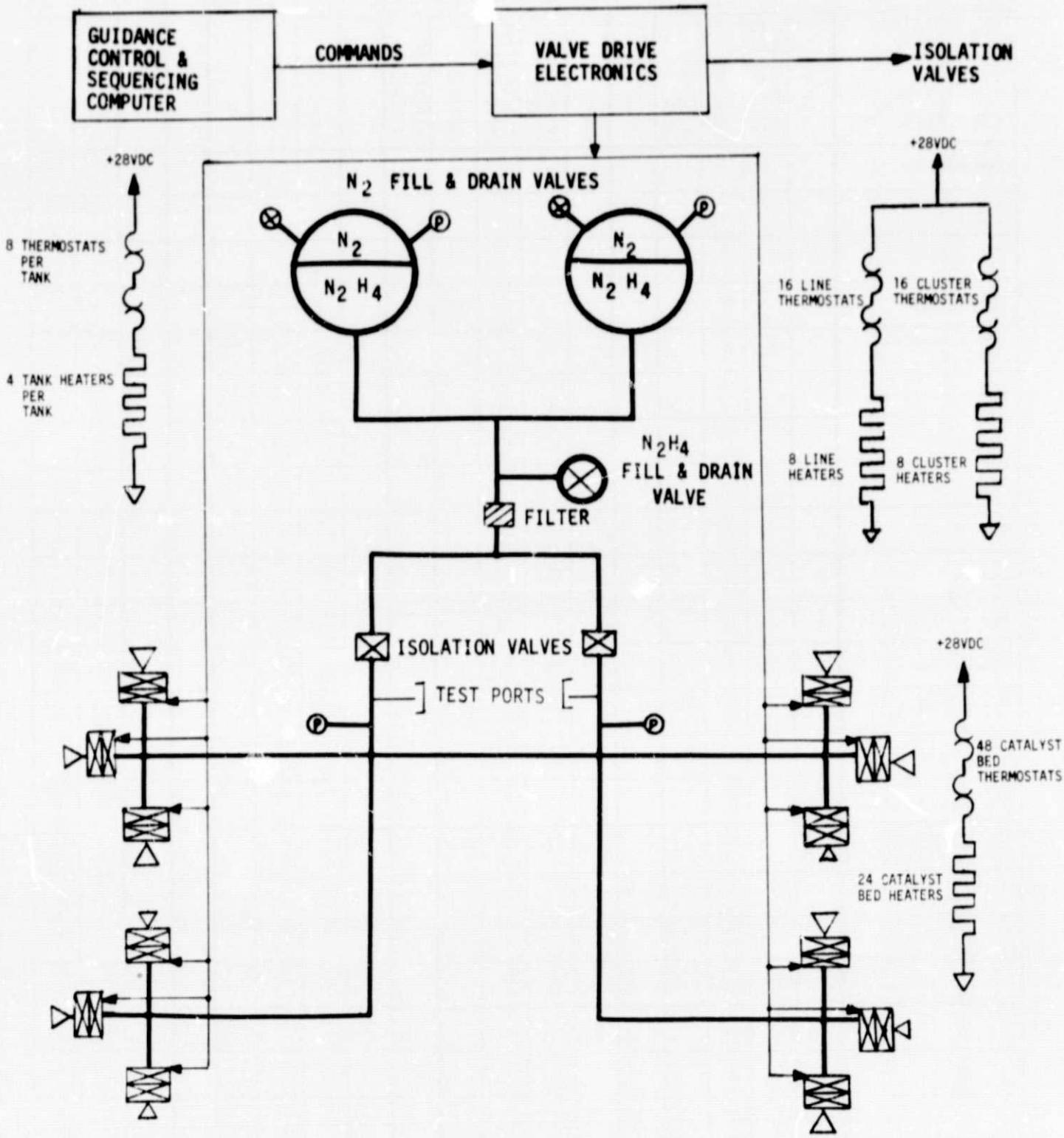
PAYLOAD HAZARD REPORT	NO. (Unique number)
PAYLOAD (Enter Payload, GSE or experiment title from Hazard list) NOTE: Separate hazard reports are required for GSE and ground ops.	PHASE (Safety Review Phase)
SUBSYSTEM (Title of Subsystem from Hazard List)	DATE (Date completed or revised)
HAZARD TITLE (Title of Hazard from Hazard List)	
APPLICABLE SAFETY REQUIREMENTS: (SP&R paragraphs from Hazard List)	
DESCRIPTION OF HAZARD: Describe the hazard and its effects on the Orbiter, other payload, the crew, and/or ground operations. Define the mission phase(s) when hazard could occur (i.e., ground operations, boost, etc.).	
HAZARD CAUSES: Itemize each possible hazard cause.	
HAZARD CONTROLS: For each hazard cause, define the controls designed into the system to preclude or minimize the occurrence of the hazard. Preliminary information may be provided for phase I and more details provided at phase II and III.	
SAFETY VERIFICATION METHODS: For phase I, identify the verification approach (i.e., test, analysis, inspection, etc.). For phase II, identify the test plan that verifies the effectiveness of the hazard control. For phase III, provide the results of the test, analysis, inspection, etc.	
STATUS: Hazard Report is open until all verification is satisfactorily completed. At phase I, provide a tentative schedule for completion of the verification task.	

CONCURRENCE	PHASE I	PHASE II
Payload Organization	(Sign and date)	
STS Operator	(Sign and date)	

APPROVAL	PHASE III
Payload Organization	STS Operator

JSC Form 5428 (Feb 78) NASA-JSC

Figure 3



ABC/RCS SYSTEM
Figure 4

PAYLOAD SAFETY MATRIX

PAYLOAD	PAYLOAD ORGANIZATION	DATE	PAGE
ABC	Joe Doe Aerospace Corp.	1/11/81	1

HAZARD GROUP / SUBSYSTEM	COLLISION	CONTAMINATION (TOXICITY, ETC)	CORROSION	ELECTRICAL SHOCK	EXPLOSION	FIRE	INJURY AND ILLNESS	LOSS OF ENTRY CAPABILITY	RADIATION	TEMPERATURE EXTREMES								
Biomedical																		
Hazard Detection and Safing*																		
Cryogenics																		
Electrical	X		X	X	X	X			X	X								
Environmental Control		X	X															
Human Factors							X											
Hydraulics																		
Materials		X			X	X												
Mechanical	X							X										
Optical	X																	
Pressure Systems	X		X		X			X										
Propulsion	X				X	X												
Pyrotechnics																		
Radiation																		
Structures	X																	

JSC Form 542 (Feb 78)

*Reference "Caution and Warning" in JSC 11123.

NASA-JSC

Figure 5

HAZARD LIST

PAYLOAD	SUBSYSTEM	DATE
ABC	Multiple	1/11/81

HAZARD GROUP	HAZARD TITLE	APPLICABLE SAFETY REQUIREMENT
	Subsystem: Propulsion	
Fire	Leakage of propellant (N_2H_4)	209-1
Collision	Inadvertent actuation of propulsion system	202-2b
Explosion	RCS propellant lines and tanks rupture during flight or deployment operations	209-1, 208-4 208-5
Explosion	Rupture of propellant lines or tanks during emergency abort operations	209-1, 208-4 208-5
	Subsystem: Structures	
Collision	Failure of primary structural assembly as a result of flight or emergency landing loads	208-1 208-2 208-3

JSC Form 542A (Feb 78) NASA-JSC

Figure 6

PAYLOAD HAZARD REPORT	NO. ABC-14
PAYLOAD: ABC	PHASE: I
SUBSYSTEM: Propulsion	DATE: 6/15/81

HAZARD TITLE:
RCS Propellant Lines and Tanks - Rupture During Flight or Deployment Operations

APPLICABLE SAFETY REQUIREMENTS:

209-1 Hazardous Materials

208-4 Pressure Vessels
208-5 Pressurized Lines and Fittings

DESCRIPTION OF HAZARD:

During flight and deployment operations, the ABC RCS system ruptures resulting in release of shrapnel and hydrazine and causing damage to the Orbiter and/or injury to the flight crew.

HAZARD CAUSES:

1. Material defects, degradation and/or undetected damage.
2. Overheating of fluid due to malfunction of temperature control system.
3. Heating and autodetonation of hydrazine vapor due to adiabatic compression when the isolation valves are initially opened.

HAZARD CONTROLS:

1. The propellant tanks will be designed to an ultimate factor of Safety of 2.5.
2. All pressurized lines and fittings shall be designed with a factor of Safety of 4.0.
3. Utilize approved and controlled procedures for operations, transportation, handling, and contamination control to preclude system damage.
4. Redundant thermal control system with automatic overtemperature cutoff

(see attached sheet)

SAFETY VERIFICATION METHODS:

1. Perform a systems analysis and a structural analysis in accordance with MIL-STD-1522. Proof tests and burst tests will be conducted.
2. Qualification testing of the thermal control system.
3. Inspection program to assure material defects are identified and proper corrective action is taken.

(see attached sheet)

STATUS:

Open.

1. System design and analysis in progress.
2. Systems and structural analyses will be completed by November 1981.
3. Proof and burst testing will be completed by June 1982.
4. Qualification testing and analyses will be completed by October 1982.

CONCURRENCE	PHASE I	PHASE II
Payload Organization	Jack Doe 6/15/81	
STS Operator		

APPROVAL	PHASE III
Payload Organization	STS Operator

JSC Form 542B (Feb 78)

NASA-JSC

Figure 7

HAZARD CONTROLS:

provisions.

5. Pressure vessel and plumbing design meets and exceeds the requirements of MIL-STD-1522.
6. The isolation valves are pyrotechnic valves and will not be opened until ABC is 200 feet from Orbiter.
7. Inadvertent opening of an isolation valve will require 3 independent failures or operator errors.

SAFETY VERIFICATION METHODS:

4. A caution will be added to operational procedures: "Do not open isolation valves until ABC is at least 200 feet from the Orbiter."
5. Analysis will be conducted to verify pressure system will tolerate failed "ON" heaters without rupture.

Figure 7
(Continued)

RADIOACTIVE SOURCE QUESTIONNAIRE

Space Flight Hardware and Applications
Lyndon B. Johnson Space Center

I. IDENTIFICATION AND DESCRIPTION

1. SOURCE OWNER: Joe Doe Aerospace Corp.	2. LICENSE NO.: AB-9876-09	X NRC / State of
3. ADDRESS: 111 W. Main, New York, NY		TELEPHONE NO.: AC (123)456-7890
4. ISOTOPE: Cobalt-60	5. QUANTITY (uCi): 10.02	AS OF: August 30, 1978
6. MANUFACTURER: Nick's Nuclear Source Fabrication	7. ADDRESS: 222 Broadway, Oak Ridge, TENN.	
8. CHEMICAL FORM: Metallic Cobalt	9. PHYSICAL STATE: Pellet	
10. SOURCE SEALED: [X] Yes [ ] No	11. IDENT. NOS.: ZR-12-CO-60	

II. TEST DATA

1. DATE SOURCE LEAK TESTED: September 5, 1978	2. RESULTS (uCi): $<1 \times 10^{-4}$

3. THERMO-VACUUM QUALIFIED TO: 100 MM HG; 1 °C + 100 °C; DATE 9/2/78

III. SOURCE DIAGRAM

(DETAILS ON SEALING, TECHNIQUES AND DIMENSIONS):

SEE ATTACHMENT 1 FOR DETAILED DRAWINGS AND NARRATIVE OF SHIELDING CHARACTERISTICS NUCLEONIC GAUGE.

IV. SOURCE USE DATA

1. JSC EXPERIMENT AND PROGRAM:

Doedata System - Nucleonic gauge for potable water storage tank.

Source contained in part number JDA 45678-9

2. PURPOSE: [ ] External Calibration [ ] Inflight Calibration [XX] Other Continual Inflight Use

3. LOCATIONS WHERE SOURCE IS TO BE USED AND OR STORED AND APPROXIMATE DATES

A. LOCATIONS	B. DATES FROM	TO
Joe Doe Aerospace Corp.	9/1/78	10/1/79
Marshall Space Flight Center	10/2/79	10/2/80
Johnson Space Center	10/3/50	11/3/80 (See attachment 2).

SOURCE SUPERVISOR OR RADIATION SAFETY OFFICER: Jack Doe	TEL.: AC (123) 456-7890
ORIGINATOR'S SIGNATURE: John Doe	DATE: 10/1/78
ORIGINATOR'S MAILING ADDRESS: 111 W. Main, New York, NY	TEL.: AC (123) 456-7890

JSC Form 44 (Rev Jun 78) NASA-JSC

Figure 8

PAYLOAD NAME: ABC

PAYLOAD MATERIAL USAGE LIST

	MATERIAL NAME	MANUFACTURER	SPEC.	GENERIC TYPE	*WEIGHT	**SURFACE AREA	LOCATION: PAYLOAD BAY	LOCATION: CREW BAY	CURE AND OR COMMENTS
1.	RTV 566	General Electric	Company Spec.	Silicone Adhesive	0.5	250	X		RT
2.	DC 620	Dow Corning	Comm.	Potting CPD	1.2	510	X	X	2 hours @ 180°F
3.									
4.									
5.									

NOTE: Payload materials located in the crew bay must comply with the Orbiter materials control requirements.

*Weight approximated to .25 lb.

**Approximated to 10 $in.^3$

JSC Form 5420 (Sep 78)

Figure 9

PAYLOAD SAFETY REQUIREMENTS WAIVER	WAIVER NO.	DATE

PAYLOAD NAME *(Include model(s) or serial(s))*

SUBSYSTEM AND SPECIFIC COMPONENT AFFECTED:

REQUIREMENT BEING WAIVED:

HAZARD OR HAZARD CAUSE *(Include reference to Payload Hazard Report.)*

REASON REQUIREMENT CANNOT BE FULFILLED:

RATIONALE FOR ACCEPTANCE: *(Attach applicable data as required to support rationale; i.e., drawings, test data, photographs, etc.)*

PAYLOAD ORGANIZATION MANAGER	DATE
NASA STS OPERATOR	DATE

JSC Form 542C (Feb 78) NASA-JSC

Figure 10

EXPERIMENT SAFETY PACKAGE COVER SHEET			① PAGE ___ OF ___
EXPERIMENT ②	PAYLOAD ③	PHASE ④	DATE ⑤

NO.	HAZARD TITLE	REMARKS	DISPOSITION
⑥	⑦	⑧	⑨

Blocks 1, 2, 3, 4, 5, 6, 7, and 11 (also 8 and 10 if applicable) should be completed by the Payload Organization.
Blocks 8, 9, 10, 12 will be completed by the STS Operator after the review.

① cover sheet page number
② experiment alphanumeric designation and title
③ payload to which experiment is assigned
④ level of review (i.e. I, II or III)
⑤ date prepared
⑥ unique number assigned to the hazard report
⑦ title of hazard report
⑧ applicable remarks related to the disposition of the hazard report (e.g. references to assigned action items or changes to report made by STS Operator or modifications, deletions etc. made by the payload organization)
⑨ STS Operator disposition of the hazard report (i.e. open, signed, disapproved, etc.)
⑩ General comments related to entire ESP (e.g. references to related interface hazard reports, action items to prepare additional hazard reports or upgrade experiment descriptive and/or support data, etc.)
⑪ ⑫ applicable signature and date

GENERAL COMMENTS:
⑩

CONCURRENCE/APPROVAL

PAYLOAD ORGANIZATION ⑪	STS OPERATOR ⑫

JSC Form 542E (Mar 78)

Figure 11

NASA-JSC